21-4

PROTECTION OF STRUCTURAL STEEL

ON THE

P. R. R. Cortlandt Street Ferry Terminal

New York City

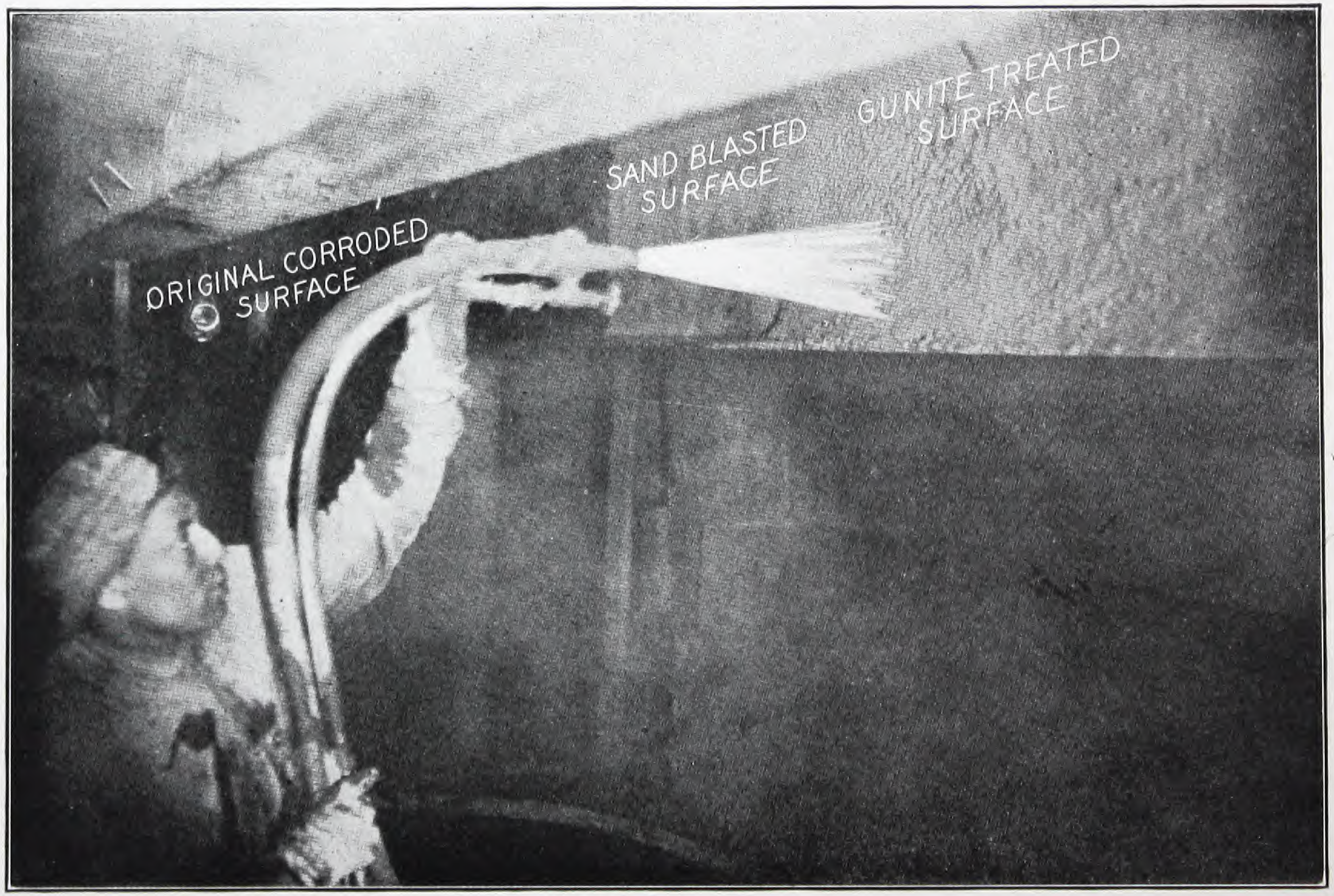
Type N-1 Cement-Gun

BULLETIN NO. 40

CEMENT-GUN COMPANY, Inc.

SOUTH 10th and MILL STREETS

ALLENTOWN, PA.



THE THREE STAGES OF THE WORK

Original Surface of Steel. Surface after Sand-blasting. The Gunite Protective Coating.

The Protection of Steel With Gunite Without Reinforcing

ONE of the most interesting jobs upon which the Cement-Gun has been used in the past year, was that of protecting the steel sub-structure of the Cortland Street Ferry Terminal of the Pennsylvania Railroad Company, New York City, from corrosion and rust, by a thin coating of Gunite, applied without reinforcing of any kind.

The first floor of this terminal was designed as a steel skeleton with wood floor-beams and floor. The steel was given a coat of linseed oil paint before shipping from the mill and had the customary coat of rust upon arrival. After erection, this was cleaned off with wire brushed, and the steel given two coats of a standard paint.

The steel in question is about four feet above high water mark; and the water of the North River at this point is very salty. Large quantities of steam escape from the drip and drain pipes through the bulkhead wall at low tide. The surface of the steel work under the floor is wet at all times, even at low tide.

It was only a short time before the paint in this section had all come off, leaving the steel exposed. The steel was again cleaned and asphaltum tried, but this was a failure and in about six months it could be dusted off with a broom.

After this attempt, nothing was done in the way of a protective coating until after three years, when the railroad engineers examined the steel and found that some action had to be taken, as it was covered with a scale and rust that could easily be pulled off in layers about 3-32″ thick. They consulted one of the engineers of the Cement-Gun Company, Inc., in reference to the problem, and he made them a proposal for doing the work which proved to be too expensive.

His proposition was to cover the steel with a wire-mesh reinforcing, and apply Gunite over this to a thickness of 1½″. This reinforcing was the costly part of the work, as there were 220 large steel girders with numerous tie-beams, etc., to be coated, and the lay-out of the wooden floor beams in connection with the steel girders, made the placing of the reinforcement very difficult. Also, a thickness of Gunite greater than needed for the protection of the steel was necessary, due to the fact that the reinforcing would of necessity be placed some distance from the steel, and the coating would have to be thick enough to fully cover and protect this reinforcing.

The question of coating the steel without reinforcing then arose. The Cement-Gun Company would not pass upon this without an exhaustive preliminary test, not being familiar with the conditions to which the coating would be subjected. The engineer in charge of the work decided to look into these conditions, and make certain tests with the view of determining whether or not it would be practical to apply the Gunite in this manner.

He first looked into the design of the steel work and found that it had been designed to carry the heavy loads with very slight deflection. That left only atmospheric conditions to be taken care of, and to determine the ability of the Gunite coating to withstand these conditions, the following test was made. It was of course necessary to thoroughly clean the steel again, no matter what was decided upon as the next protection.

A piece of 4″ x 4″ angle iron, two feet long was first sand-blasted to gray metal, and left with a smooth surface. The steel work under the floor of the building was very badly pitted by corrosion, and therefore it was evident that after cleaning, the surface would be rougher than the test sample, hence affording a better bonding surface. About one hour after the sample was cleaned, it was coated with a 1:3 mixture of cement and sand, applied by the Cement-Gun process to a thickness of from ¼″ to ½″. Sample was then stored in moist salt air for three days, and then submerged in salt water from the river for three days more. The pan containing the salt water and the sample was then carried to a cold storage house close by. Here the sample was taken out, placed in a clean dry wooden box on a sheet of white paper, and stored at a steady temperature of five degrees below zero for a period of 48 hours.

Upon examination at the end of this time not a particle of cement had flaked off. It was coated with ice, so was taken into a warm room and left to thaw out over night. In the morning there were only the water marks on the paper. No flaking whatever had occurred.

The sample was then placed on top of the boiler in a power house where the temperature was 110° F. It was left there for three days, after which it was examined under a microscope and found intact. No hair cracks whatsoever were visible, and no cement had flaked off.

After allowing it to cool it was given a two-foot drop on a wooden floor and then on a cement floor. Microscopic examination again failed to reveal any cracks or checks. To find if the water had penetrated the coating, which would be shown by spots of rust in the steel, the sample was given a ten-foot drop on a cement floor. This broke the coating from the outside of the angle, but not from the inside. There was no sign of corrosion,—the surface was as clean as when it came from the sand-blast. The neat cement bond and the glazed cement finish, both exclusive features of the Cement-Gun process, were noted by the testing engineers.

The above tests satisfied the railroad company that the proposition was practical, and an equipment was taken for the work, comprising two sand-blast machines and a Cement-Gun. All the steel was first sand-blasted to gray metal, and this coated with Gunite to a thickness varying from ¼″ to ½″. The work was started early in October, and completed about January 1, 1915. Examination of the work that has been completed for four months, and over which the heaviest loads have passed, shows no sign of cracking, and the ringing sound given forth when struck with a hammer, indicates the strong and perfect bond of the Gunite to the steel.

S. & D.—10 M 4-20-17

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